Chapter 37

The Dilemma for the History of Modern Maps Based on Neo-Cartographic Technologies

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Abstract

Nowadays map repertoire expands the outcome of traditional mapping technologies by digital-, multimedia- and neo-cartographic aspects. Especially neo-cartographic characteristics (ubiquitous cartography, user participation and geo-communication) are new paradigms in modern cartography. This new expansion of digital-, multimedia- and Internet-cartography combines the latest Web developments with traditional cartography and psychological imagery research. In terms of a prospective cartographic heritage these modern developments lead to a starting dilemma on the archiving of involved digital technologies and map contents. Even if new archiving methods for digital applications and data were developed in the past decade, Service-Oriented Architectures (SOA) and distributed network applications still wait for appropriate archiving procedures. Initial considerations and questions on solving this starting archiving dilemma for the history of modern maps are this discussed in this contribution.

Keywords: cartographic heritage, neo-cartographic technologies, archiving, history of modern maps

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37.1 Introduction

Historic geospatial contents form an important part in actual planning, documentation and cartographic applications. Spatial planning situations take historic developments or states into account and therefore use historic maps, cartographic applications and geo-reference data. The main dilemma with historical geospatial content occurs, when the required content cannot be accessed, understood or (geo-) referenced, which is a result of technological dependencies, loss of semiotic description and loss of metadata descriptions. Analogue maps, like paper maps, offer a visible depiction at any time and request a legend and reference frame in order to be spatially usable. Simple digital maps need much more: beside an application that offers some interaction with the digital map, the format, the data´s reference frame, transmitting media and transmitting media´s characteristics / requirements need to be supported in order to receive a visible map. This requirement´s complexity is also true for (primary) digital geoinformation, which is mainly stored in bits and bytes. This ongoing investigation within the commission on digital technologies of cartographic heritage focuses on the latest developments of modern maps, which lead to neo-cartographic environments and its related archiving concepts. The steps from digital maps to multimedia-, web-, and Service-oriented maps result in real-time content which is affected by user participation in ubiquitous environments. It becomes obvious that these distributed, interactive, multimedia and real-time maps can hardly be archived by following old archiving paradigms: to keep the application/content in a save place forever. Instead, new methods have to be developed in order to ensure historic applications of tomorrow. Accompanied by technical methods, legal issues and the interdisciplinary understanding of archiving have to be adapted to the prospective historic use of digital geoinformation and modern maps. This is a starting point to overcome the main dilemma for the history in modern cartography.

37.2 Towards the Understanding of Modern Cartography

Modern cartography is heavily influenced by digital approaches. Reproduction processes as well as dissemination procedures make use of digital mechanisms that mostly enhance traditional processes. This technical changes lead to new and extended applications as well as use cases. Thus the access to geospatial information becomes public and even the creation of maps can be done by public too, as it is shown with the OpenStreetMap (www.openstreetmap.org) initiative. In terms of cartographic heritage these technological developments of neo-geography result in new challenges for enabling sustainable cartographic heritage for the future. Their conceptual structure, intermedial dependencies and technical requirements lead to a more complicated framework. These technological developments of cartographic visualization come up with new notions, which should be briefly explained in order to provide an overview of the successional meaning.

Geovisualization includes scientific visualization of geospatial content, which is mostly derived from data analysis (Andrienko et al 2007). Geovisualization focuses on the use of computer graphics to create visual images which aid in understanding of complex, often massive numerical representation of geospatial concepts or results. It emphasizes knowledge creation by different information visualization and therefore extends knowledge storage. The combination of GIS (analysis) and geovisualization allows for a more interactive exploration of data with the base functionalities of map layer exploration, zooming, altering of visual appearance and digital interfaces (Jiang et al 2003). Additionally geovisualization advantages concern the ability to render time- and space-changes in real time, expand the visual exploration to n-dimensions and allows users to adjust mapped data abstraction in real time (MacEachren et al 1997).

Web mapping describes creation and dissemination processes for maps that make use of the Internet. These processes cover the designing, implementing, generating and delivering of maps via the World Wide Web (Peterson 2003). Beside the technological issues of how to establish Internet maps, theoretic aspects concern additional studies of web mapping: the usability of web maps, the techniques and workflows' optimization and even social aspects (Kraak et al 2001). Therefore web mapping serves as presentation media with an increasingly amount of analytical capabilities (Web GIS, Web Services). In addition developing client devices, like PDA, hand-held or mobile phones, expand web mapping to ubiquitous cartography, where maps are time- and space- independently available (Raper et al 2007).

Geospatial Web Map Services (WMS) focus on a server sided processing of geospatial information with the general aim to render simple images and send these to the client. Variations of Web Services (WFS, WCS, WPS, WPVS ... www.opengeospatial.org) even enable direct manipulation of geospatial database contents and analysis, which simulates full GIS functionality via the Internet. As effect these services have great impact on expert's and layperson's user experience.

Location Based Services (LBS) make use of Web Services by reason of utilizing the geographical position of a device and offering location and task relevant information and entertainment services. Thus LBS incorporate services to locate the device, to access content gazetteers, which enable the use of various information, and to possibly track user moods. For example LBS include personalized weather services or location based games (Reichenbacher 2004).

Locative Media describe media of communication that are bound to a location. Accompanied by the technical possibilities of Web Services and LBS, digital presentation media (pictures, video, sound ...) can be virtually applied to locations.

This leads to a triggering of real social interactions. Although mobile positioning technologies, like GPS or mobile phones, enable the intense spreading of location media, these technologies are not the main aim for an ongoing development in projects in this field. Instead the social component, which provides information on the relationship of consciousness to a place and other people, forms the framework to actively engage, discuss and shape spatial bound topics in a very wide public environment (Galloway et al 2005).

The notion neo-geography subsumes public use and creation of geospatial data. It can be seen that the public use of web technologies is a major development in cartography that opens new opportunities. Neo-geography is a notion for “new geography”, which bases on a public access to geospatial data and participation in geographic applications (Turner 2006). The access to geospatial data is executed via the Internet and various Web Services. One does not have to load complete datasets to the client computer, but receives simple pictures according to the requests of Web Services that may be used by specific applications (like Google Earth). The participation in geographic applications describes the user’s possibility of recording and sharing geospatial data, which have special personal/individual importance.

In addition to the public recording and exchanging of geospatial data, the notion neo-cartography combines neo-geographic characteristics with ubiquitous cartography and geo-media techniques. Beside a time- and space-independent access to maps and modification of geospatial data, neo-cartography takes the characteristics of transmitting media, the impact of information-content and user needs for the presentation of geospatial information into account. The new aspects of neo-cartography indicate the possibility to directly access mental imagery by using user inputs. The ubiquitous existence of maps and a public participation develop a social imagery of space that should be used for the abstracted and simplified presentation of space.

37.3 The Technological Environment of Modern Maps

The development of digital environments in GIScience over the past decades has been resulted in a diverse amount of tools available for cartographic multimedia applications. This ongoing evolving process has led to new methods, formats and applications for playing, reading or accessing incorporated content. One main reason for this rapid development may be motivated by adapting the latest technology available, which concerns processing and displaying resources using hardware or new software creations. In this sense the impact on cartographic multimedia applications is characterized by new technical possibilities, like interactivity, dynamic animation techniques or immersive information transfer. Additionally the domains of GIScience benefit from decentralization of software architectures and data management, which enables a more effective recording of data and interoperability (Kraak et al 2001). These decentralized and service oriented architectures are consequently used by cartographic applications on the basis of the Internet and ubiquitous frameworks. In terms of cartographic heritage digitalization of creation processes and end-user products basically lead to changes within the archiving paradigm, which generally means to store and save information. An advanced expansion to decentralized architectures then causes massive challenges in technical-, legal- and theoretic aspects of archiving geoinformation.

Independence by time and space: One main characteristic of modern cartography, especially ubiquitous cartography, is its time- and space independence. Cartographic applications and geospatial content can be accessed any time and everywhere for any occasion. The Internet as well as wireless transmission technologies make this access possible. Therefore a highly context sensitive content, which covers all possible eventualities, describes the basement for most usable ubiquitous cartographic applications (Reichenbacher 2004, Nivala 2005). The content and application should be usable in any situation, like a leisure- or business trip, which may also change during a journey. In consideration of cartographic heritage this content flexibility leads to a complex archiving structure that needs ongoing investigation. On one hand masses of information wait for their combination and appropriate use, on the other hand distributed networks, ad-hoc connections and active as well as passive sensors establish an ubiquitous environment. Neither emulation nor migration, as these are in use for archiving information and applications nowadays, can help for archiving an ubiquitous environment. This special cartographic application, which depends on distributed networks and ad-hoc connections in order to build up an ubiquitous environment, cannot be isolated, put in an image and kept functional (of the user interface and content exploration) by reason of archiving. Thus the development of appropriate archiving strategies is requested for future investigations.

User participation is another big aspect in modern cartography. Using special devices/sensors and distributed networks (or more general: ubiquitous environments), map users are able to collect geospatial data and even leave their "moods" for specific places behind. These collections are then incorporated into the geospatial environment/application, which may be used by others. The same social mechanism and technology is used for the collection of geodata in order to establish freely available geodatasets. As consequence of this "social mapping activity", social interesting areas and topics can be identified, which is most essential information for a series of user-oriented cartographic tasks. In terms of cartographic heritage it becomes obvious that "saving" this dynamic content leads to more questions than solutions at the moment. How can we deal with the notion of completeness? What does actuality mean for these social-based data? Can incremental archiving procedures created? In fact the social image of geospatial facts will also be influenced by individual knowledge/perspectives, social preferences, political motivated interests and so on. Maybe the social interest can also be motivated in a way that sustainable archiving can be solved in distributed networks in future.

The cartographic heritage relevant core aspects of modern cartography show the increasing complexity of digital heritage architectures. In addition to digital requirements, individual and social interests are increasingly embedded in geospatial structures, which leads to unrevealed archiving processes. In the end the question for sensitive map content and applications arises. What are the historical values that are worth saving? Is it enough to keep original data (first model data) or do we have to save the map product or even entire virtual environments for keeping our cartographic heritage?

37.4 Archiving Aspects for a Prospective Historic Use

From a historical point of view, maps can tell a lot of passed and unknown circumstances, either by means of topography or the influence of policy, culture and pragmatics on the content. Thus the exploration of the past can be supported by accessing this documented information in maps for some extend. This is the main reason and importance for saving and disseminating cartographic heritage also in future decades. Historical values in context with maps generally cover cultural, geometric and informative values. Cultural values show how the map content was actually understood or used and thus became abstracted/depicted within the map graphics. For example political influences become obvious when map graphics were distorted for specific propaganda expressions. Geometric values describe the precision of map projection on one hand and document the relation to reality on the other hand, like topographic elements show the location of real world objects. Informative values mainly discover influences of technical driven processes. Due to technical developments, map production technologies change.

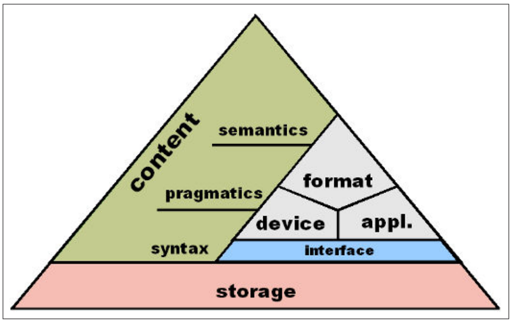

Fig. 37.1. A simple cartographic heritage structure that depicts dependencies for digital based technologies

The depiction of a conceptual cartographic heritage architecture shows main dependencies of considered core components. On one hand this graphic additionally shows the grade of digitalization, on the other hand cartographic heritage depth can be defined. The grade of digitalization starts with content and its storage media. In principle this categorization begins with analogue media, like a paper map on its storage media paper and a printed content. As soon as a digital content has to be processed, the device and format of the data become important. Consequently the processing application and its dependencies have to be considered. Cartographic heritage depth covers content-based- and artistic-based parts of historic values. Thus a very first description of cartographic heritage starts with storage media, its material, fabrication and condition. In a next step the content with its syntax, pragmatics and semantics adds to storage media. Storage media and content together form some kind of artefact, which allows to suggest the application and usability framework. Finally full cartographic heritage depth for an digital cartographic tool additionally covers device, format and application.

The format, application and device form a triangle, which depicts a very close relation of these components. The format has to be processed by an application and therefore understood by this piece of software. In addition the format has to make sense for the device, which means that e.g. sound formats will not be usable by graphical devices. The application needs to support a format and the device. Normally the application transforms a file's content for a specific device. For example a mixture of 2D geodata are processed by an application to show a virtual 3D city model. According to this, the specific device including its processing hardware has to understand the output of an application and present it in a most appropriate way (which includes that the interface is capable and best suited for this specification). For example the rendering of a virtual 3D city model will deliver a more immersive information transmission on stereoscopic interfaces than on standard displays.

The content with its semantic, pragmatic and syntactic dimension bases on the triangle of format, application and device. Looking at a bottom-up approach in the given graphic, the dimensions of content are accordingly placed to the device, application and format. In terms of cartography the syntax of the content follows characteristics of the device (resolution, immersion ...) and application (interaction, dynamics ...). For example the resolution of a device defines information depth and therefore affects the preparation of information. The pragmatic dimension relates to the device, application and format. All three parts guarantee best/appropriate usability in specific situations. The semantic dimension mainly pertains to the format, which can additionally map the meaning of a content. For example an object-oriented structure may map the meaning and relations of natural element structures.

However, the described graphic from above can only depict a first conceptual architecture of cartographic heritage. In fact more aspects have to be considered,

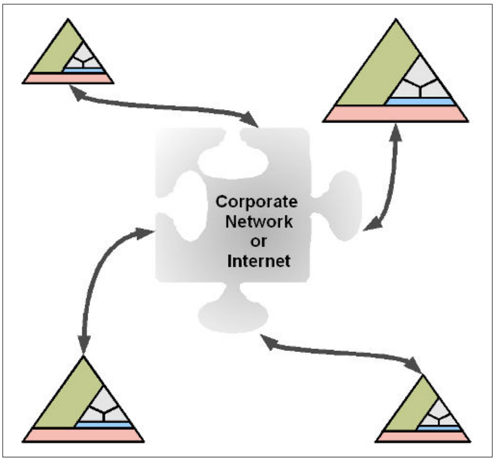

Fig. 37.2. The conceptual cartographic heritage structure in a distributed (Service-oriented) architecture. In addition to the complex single cartographic applications, the network structure or at least its functionality, protocols, actuality and integrity needs to be mapped.

when looking into detail. For example storage strategies vary for applications, formats, content semantics or devices (Borghoff et all 2003). Instead of one single technique to comprehensively save cartographic heritage, different methods are needed for the different parts. From another point of view a lot of questions arise when thinking on service-oriented architectures (e.g. Hagedorn et al 2007): How can we archive service-oriented applications, that depend on the Internet, communication protocols and ad-hoc connections? The conceptual architecture may help to keep the main dependencies within the range of vision when going into more detail.

37.5 Starting Points for Solving the Dilemma

The dilemma for the history of modern maps bases on long-established paradigms of archiving, the legal framework for archiving institutions, digital media lifetimes, missing responsibilities and so forth. Established paradigms of archiving with their understanding of "keep and save" cannot be adapted to digital media, because digital media´s lifetimes are too short. Additionally their technical (hardware) dependency leads to a loss of all embedded information in the shortest time. Either the information carrier (e.g. floppy, CD ...) becomes damaged, a reading device is missing or interfaces between device and computer do not exist anymore. This leads to copying procedures from old storage media to latest available information carriers (as it is done in data center). But this will not prevent from data loss due to outdated software and formats. This situation makes it obvious that new archiving paradigms are needed for the digital era.

Legal issues (especially in Germany and Austria) concern the archiving concept, its understanding of the notion archiving, the role of archiving institutions and their activities of selection. In general the understanding of "archives and collections" is formed by collecting media that felt into desuetude and which document political decisions. Therefore archives will undertake massive selections of worthy information/applications and cartographic contents. At the moment the status and digital procedure of archives and collections is not that clear and has to be discussed. Especially responsibilities to collect, to sustainably store, to keep read- and playable and to provide the access to geospatial content/applications have to be defined in a legal framework, in order to establish working and sustainable sequences for "digital archiving". Until then there is an urgent need to "keep modern maps online", in terms of keeping the knowledge of their existence, metadata and technical dependencies. As long as responsibilities for archiving are not legally effective, the creators of digital data and maps are responsible for their long-term existence on their own, otherwise the loss of digital geospatial evidence for our geospatial era is in all probability (Bergeron 2002).

37.6 Conclusion

Concluding this first valuation for the expected history of modern maps it becomes clear that a legal framework will help to structure responsibilities. According to these responsibilities technological archiving procedures can be adapted and implemented. Thus an intense discussion concerning the prospective cartographic heritage within an interdisciplinary environment has to be firstly done to clear next urgent steps for archiving distributed networks and modern cartographic applications as well as digital geographic base data.

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